

299-W15-10 (A4916) Log Data Report

Borehole Information:

Borehole: 299-W15-10 (A4916)		Site: 216-Z-16 Crib			
Coordinates (WA State Plane)		GWL (ft)¹: 232.65	GWL Date: 08/19/2003		
North	East	Drill Date	TOC² Elevation	Total Depth (ft)	Type
135,981.14 m	566,448.63 m	Jan. 1968	207.6 m	300	Cable Tool

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Welded steel	3.0	8 5/8	8	5/16	+3.0	300
The logging engineer measured the casing stickup using a steel tape. A caliper was used to determine the outside casing diameter. The caliper and inside casing diameter were measured using a steel tape, and measurements were rounded to the nearest 1/16 in. Casing bottom is as reported from the well completion summary report (Ledgerwood 1993).						

Borehole Notes:

Borehole coordinates, elevation, and well construction information, as shown in the above tables, are from measurements by Stoller field personnel, Ledgerwood (1993), and HWIS³. Zero reference is the top of the 8-in. casing. Radon gas is probably contaminating this borehole. Before logging began, swab samples surveyed on consecutive days initially showed elevated levels of gamma and alpha radiation. The next day the samples were at background levels. The change between the two surveys implies the decay of radon gas.

Logging Equipment Information:

Logging System:	Gamma 1E	Type:	SGLS (70%) 34TP40587A
Calibration Date:	07/2003	Calibration Reference:	GJO-2003-468-TAR
		Logging Procedure:	MAC-HGLP 1.6.5, Rev. 0

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2 / Repeat	3		
Date	08/20/03	08/21/03	08/21/03		
Logging Engineer	Spatz	Spatz	Spatz		
Start Depth (ft)	231.0	52.0	27.0		
Finish Depth (ft)	28.0	28.0	3.0		
Count Time (sec)	100	100	100		
Live/Real	R	R	R		
Shield (Y/N)	N/A ⁴	N/A	N/A		
MSA Interval (ft)	1.0	1.0	1.0		

Log Run	1	2 / Repeat	3		
ft/min	N/A	N/A	N/A		
Pre-Verification	AE022CAB	AE023CAB	AE023CAB		
Start File	AE022000	AE023000	AE023025		
Finish File	AE022203	AE023024	AE023049		
Post-Verification	AE022CAA	AE023CAA	AE023CAA		
Depth Return Error (in.)	+1	N/A	0		
Comments	No fine-gain adjustment.	Repeat section.	No fine-gain adjustment.		

Logging Operation Notes:

Zero reference was top of the 8-in. casing. Logging was performed without a centralizer installed on the sonde. Pre- and post-survey verification measurements for the SGLS employed the Amersham KUT (^{40}K , ^{238}U , and ^{232}Th) verifier with serial number 118. Logging began approximately 1 ft above groundwater.

Analysis Notes:

Analyst:	Sobczyk	Date:	9/29/03	Reference:	GJO-HGLP 1.6.3, Rev. 0
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SGLS pre-run and post-run verification spectra were collected at the beginning and end of the day. The verification spectra were all within the control limits except for the pre-run verification spectra. Both AE022CAB and AE023CAB were slightly above the upper lower control limit for the 1461-keV peak counts per second (cps) value. The peak counts per second at the 609-keV, 1461-keV, and 2615-keV photopeaks on the post-run verification spectra as compared to the pre-run verification spectra for each day were between 2 percent lower and 1.3 percent higher at the end of the day. Examinations of spectra indicate that the detector appears to have functioned normally during logging, and the spectra are accepted.

Log spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Pre-run verification spectra were used to determine the energy and resolution calibration for processing the data using APTEC SUPERVISOR. Concentrations were calculated in EXCEL (source file: G1EJul03.xls). Zero reference was the top of the 8-in. casing. On the basis of Ledgerwood (1993) and field measurements, the casing configuration was assumed as one string of 8-in. casing with a thickness of 5/16 in. to 231 ft (total logging depth). Dead time and water corrections were not required.

Log Plot Notes:

Separate log plots are provided for gross gamma and dead time, naturally occurring radionuclides (^{40}K , ^{238}U , and ^{232}Th), and man-made radionuclides. Plots of the repeat logs versus the original logs are included. In addition, a comparison log plot of ^{137}Cs is provided to compare the data collected by Westinghouse Hanford Company's Radionuclide Logging System (RLS) with SGLS data. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, or casing correction. These errors are discussed in the calibration report. A combination plot is also included to facilitate correlation. The ^{214}Bi peak at 1764 keV was used to determine the naturally occurring ^{238}U concentrations on the combination plot rather than the ^{214}Bi peak at 609 keV because it is less affected by the presence of radon in the borehole.

Results and Interpretations:

^{137}Cs was the only man-made radionuclide detected in this borehole. ^{137}Cs was detected at the ground surface (3 ft), 18 ft, 63 ft, and 110 ft with a concentration near the MDL (0.2 pCi/g). After examination of the individual spectra, it was determined that there is no evidence of a photopeak at 662 keV at the depths of 18 ft, 63 ft, and 110 ft. These reported peaks are probably the result of statistical fluctuation.

The behavior of the naturally occurring ^{238}U log (measured by ^{214}Bi) suggests that radon may be present inside the borehole casing. Determination of ^{238}U is based on measurement of gamma activity at 609 and/or 1764 keV associated with ^{214}Bi , under the assumption of secular equilibrium in the decay chain. However, ^{214}Bi is also a short-term daughter of ^{222}Rn . When radon is present, ^{214}Bi will tend to “plate” onto the casing wall and will quickly reach equilibrium with ^{222}Rn . The reason for variations in radon content between log runs on successive days is not known. Variations in radon content in boreholes are probably related to variations in surface weather conditions. Radon daughters such as ^{214}Bi may also “plate” onto the sonde itself. When this occurs, there is a gradual increase in total counts as well as photopeak counts associated with ^{214}Bi and ^{214}Pb . This phenomenon appears to best explain the observed discrepancy in ^{238}U values based on 609 keV between the original and repeat log runs. On the basis of the ^{238}U log, ^{222}Rn is most evident in the upper 28 ft of the log.

The presence of radon is not an indication of man-made contamination; it is derived from decay of naturally occurring uranium. As a gas, radon moves easily in the subsurface, and concentrations of radon and its associated progeny can change quickly.

The plots of the repeat logs demonstrate reasonable repeatability of the SGLS data. Taking into account the effects of radon, the plots of the repeat logs demonstrate reasonable repeatability of the SGLS data for the natural radionuclides at energy levels of 1461 and 2614 keV.

Recognizable changes in the KUT logs occurred in this borehole. ^{40}K concentrations decrease by approximately 4 pCi/g at 10 ft. An increase of approximately 5 pCi/g in ^{40}K and 0.5 pCi/g in ^{232}Th concentrations occurs between 75 and 87 ft. ^{232}Th concentrations increase by 0.5 pCi/g in the interval between 54 and 62 ft. An increase in ^{40}K , ^{232}Th , and total gamma occurs in the interval between 122 and 128 ft. ^{40}K concentrations increase by approximately 4 pCi/g at 170 ft.

A comparison log plot of data collected in 1993 by Westinghouse Hanford Company and in 2003 by Stoller is included. The 1993 concentration data for ^{137}Cs are decayed to the date of the SGLS logging event in August 2003 and shifted from a ground level reference to a TOC reference. On the 2003 logs, the apparent ^{137}Cs concentrations are as predicted by decay alone when compared to the 1993 log.

Gross gamma logs from Fecht et al. (1977) (attached) indicate that the sediments surrounding this borehole probably contained only background amounts of gamma radiation from 1968 through 1976. The logs from 2/20/68, 2/25/70, and 5/7/76 appear to detect only natural gamma activity. The SGLS and RLS detected trace amounts of ^{137}Cs at the ground surface.

References:

Fecht, K.R., G.V. Last, and K.R. Price, 1977. *Evaluation of Scintillation Probe Profiles from 200 Area Crib Monitoring Wells*, ARH-ST-156, Atlantic Richfield Hanford Company, Richland, Washington.

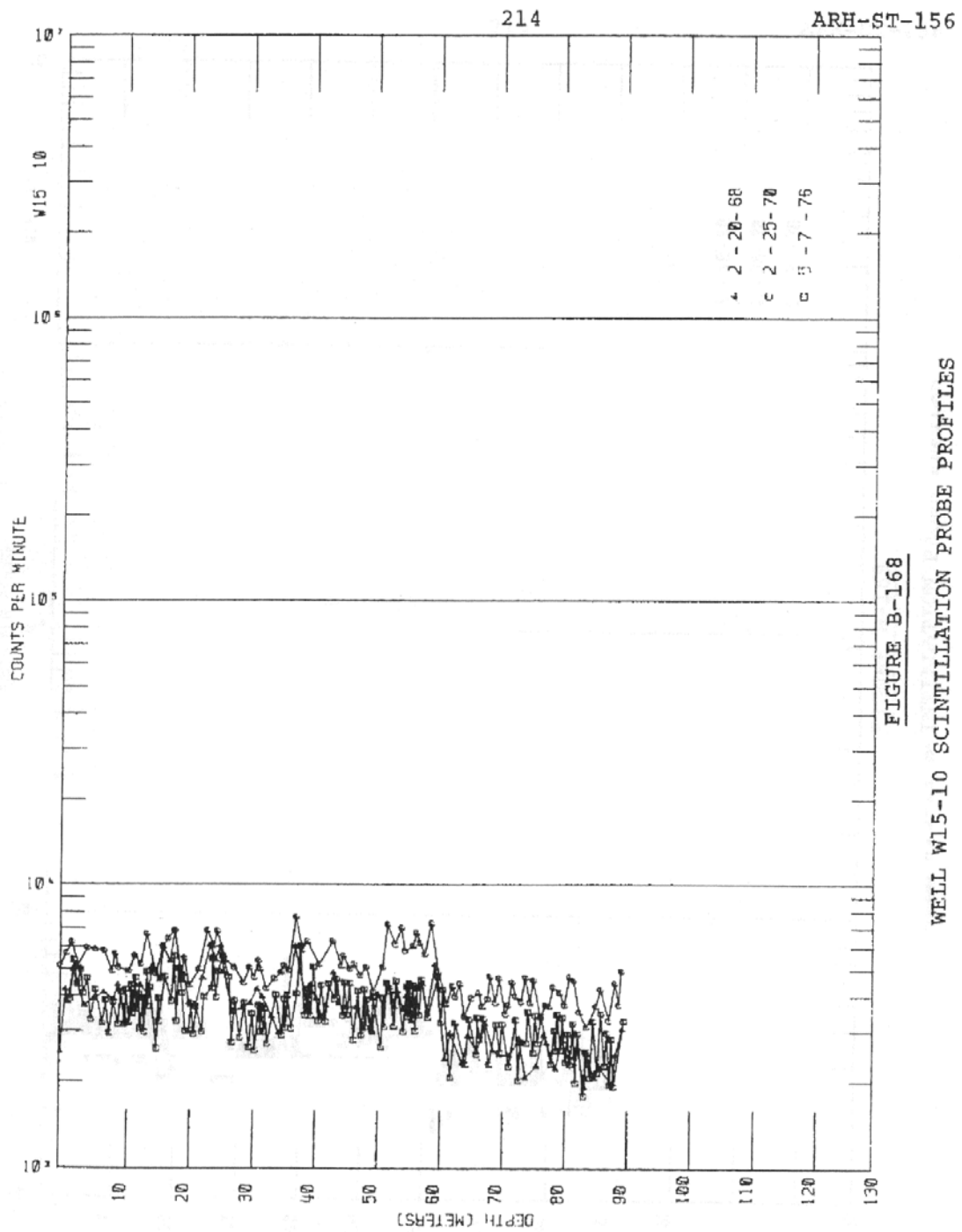
Ledgerwood, R.K., 1993. *Summaries of Well Construction Data and Field Observations for Existing 200-West Resource Protection Wells*, WHC-SD-ER-TI-005, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

¹ GWL – groundwater level

² TOC – top of casing

³ HWIS – Hanford Well Information System

⁴ N/A – not applicable

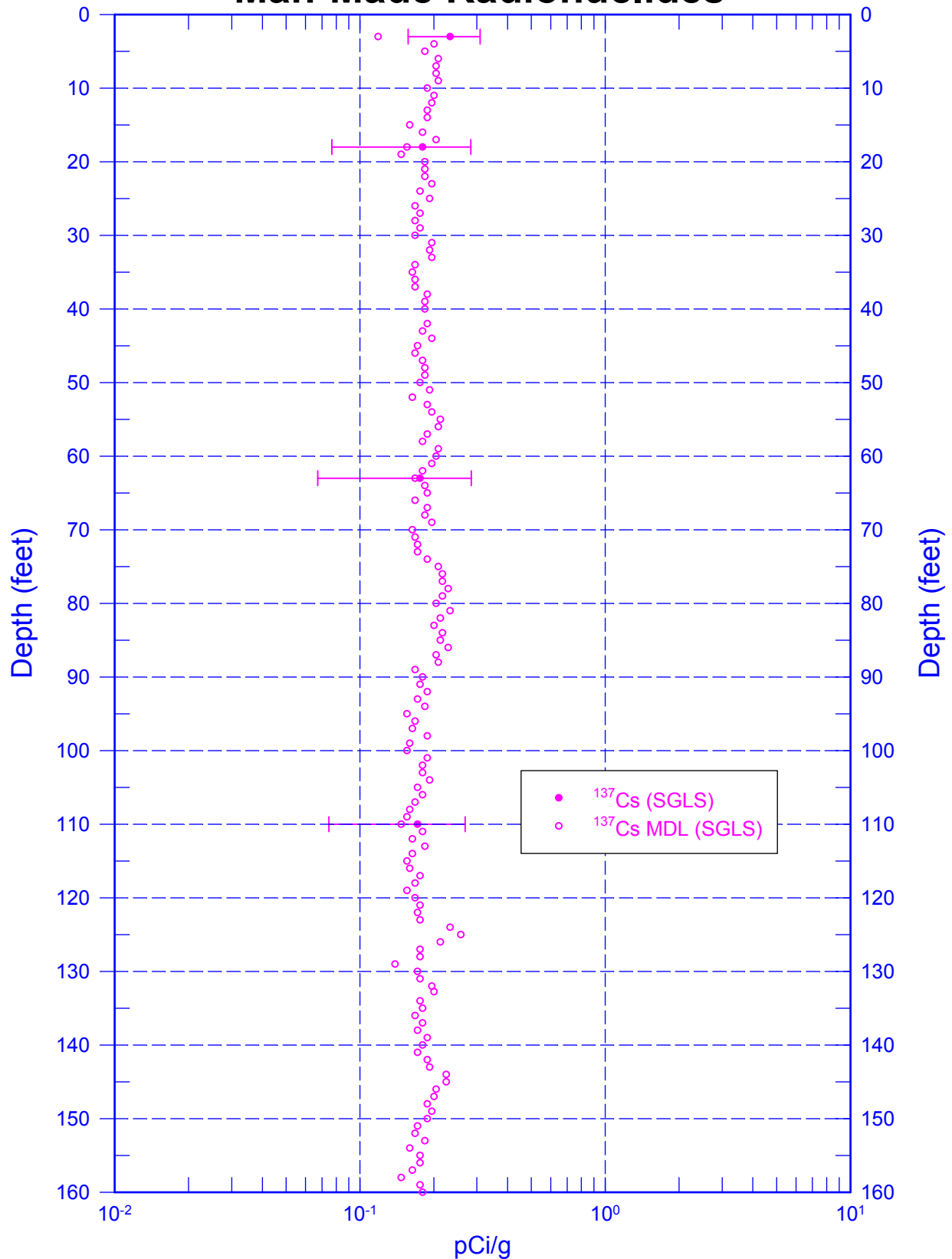


from Fecht et al. (1977)

Scintillation Probe Profiles for Borehole 299-W15-10, Logged on 2/20/68, 2/25/70, and 5/7/76

299-W15-10 (A4916)

Man-Made Radionuclides

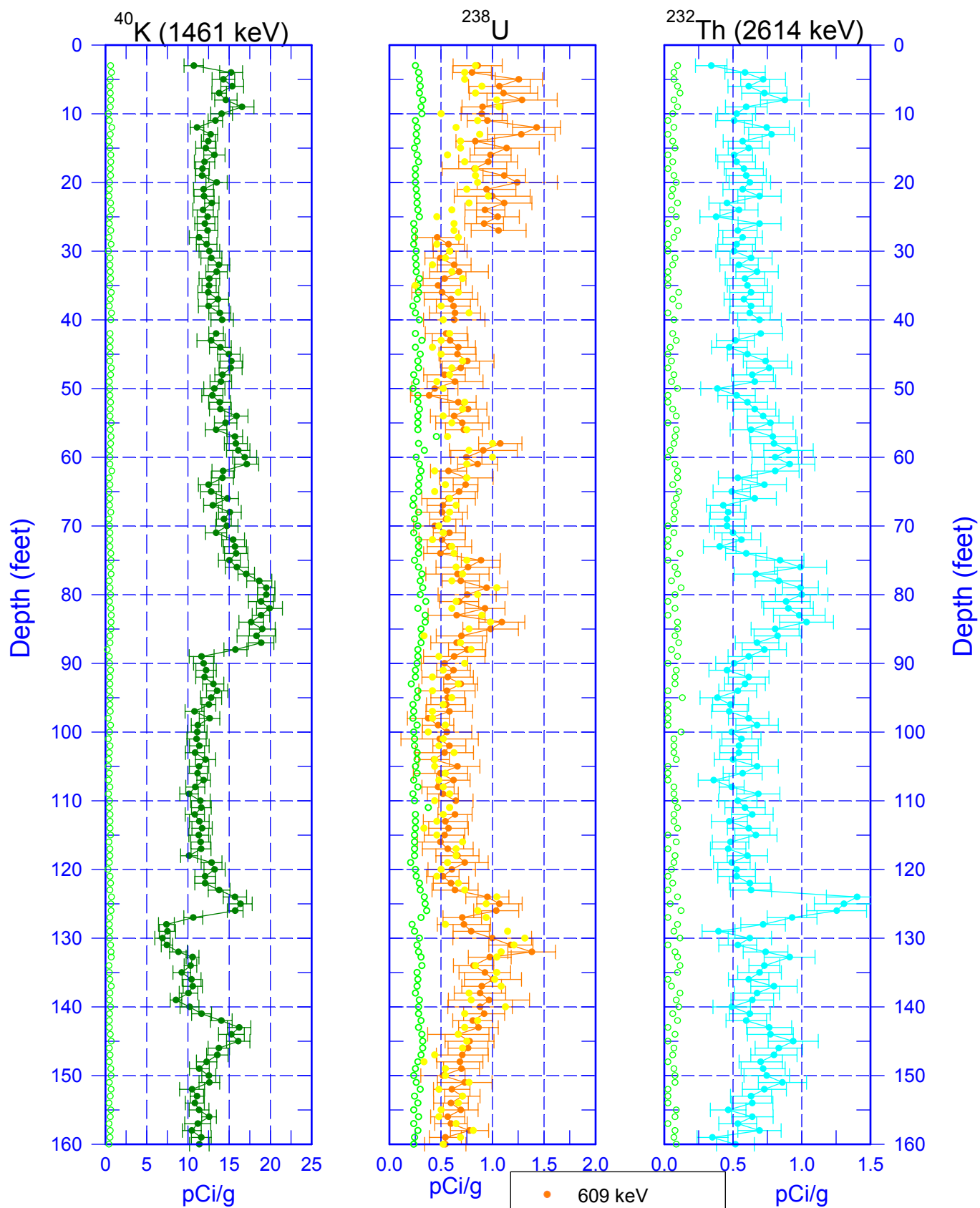


Zero Reference = Top of Casing

Date of Last Logging Run
8/21/2003

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Natural Gamma Logs

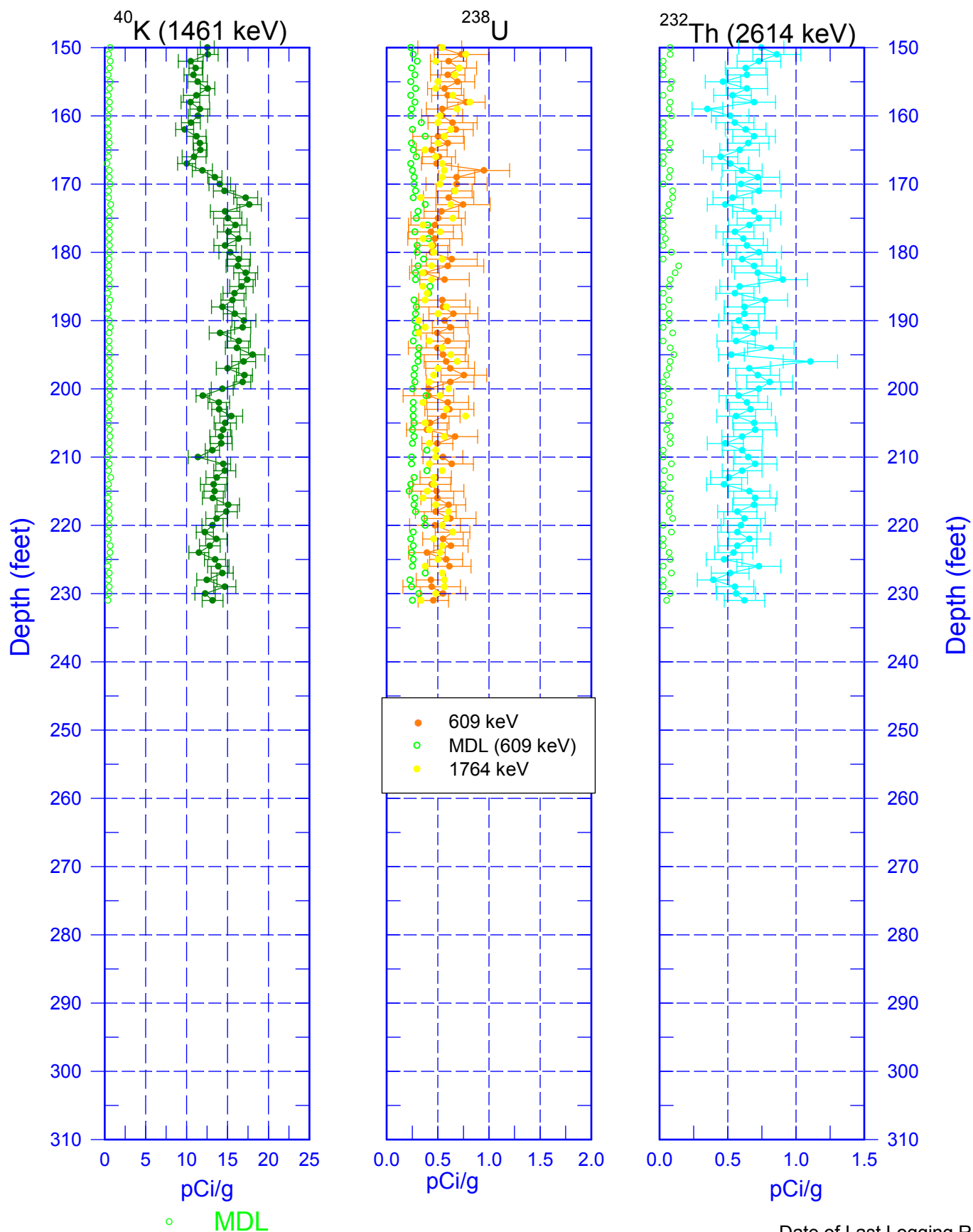


Zero Reference = Top of Casing

Date of Last Logging Run
8/21/2003

299-W15-10 (A4916)

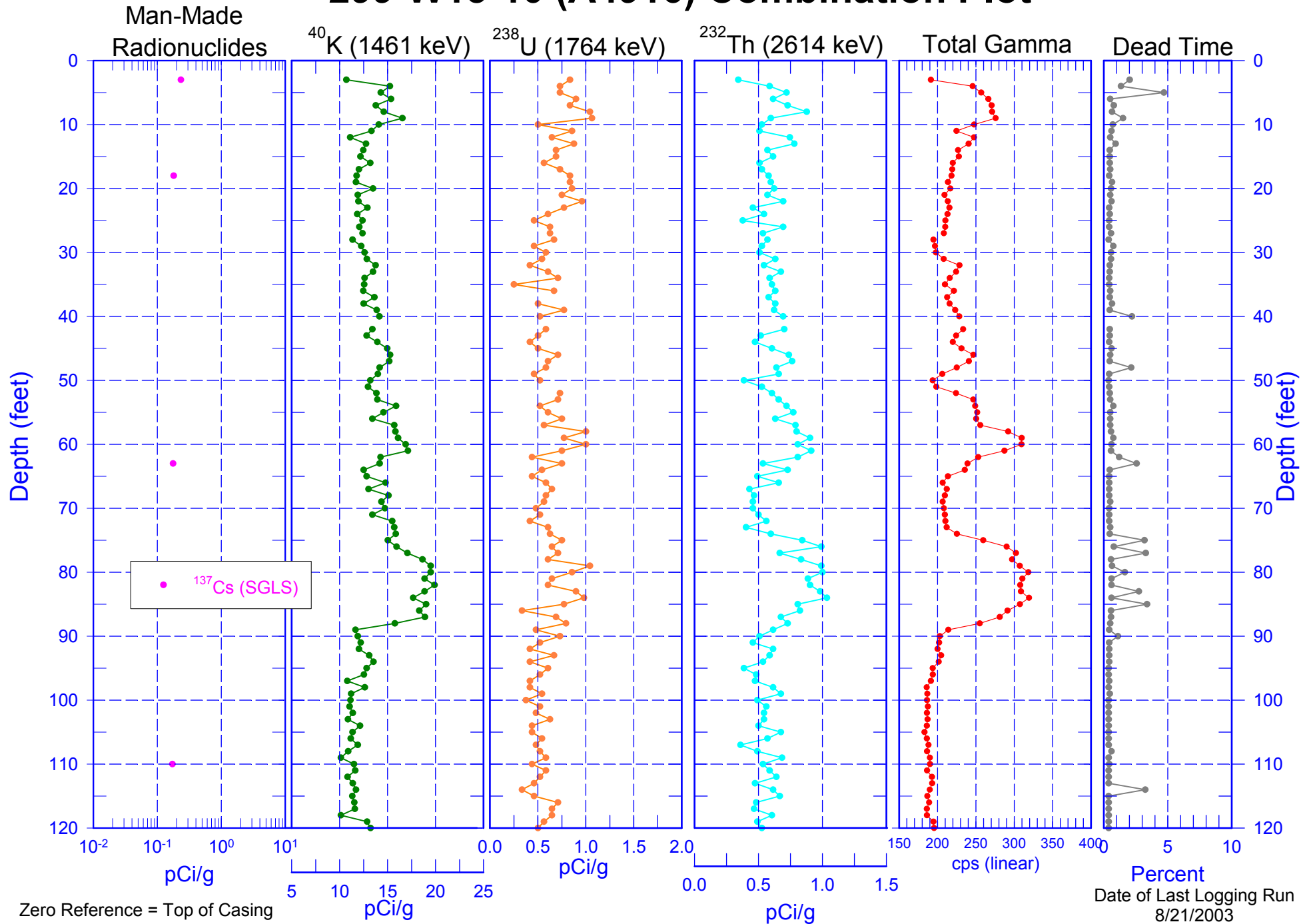
Natural Gamma Logs



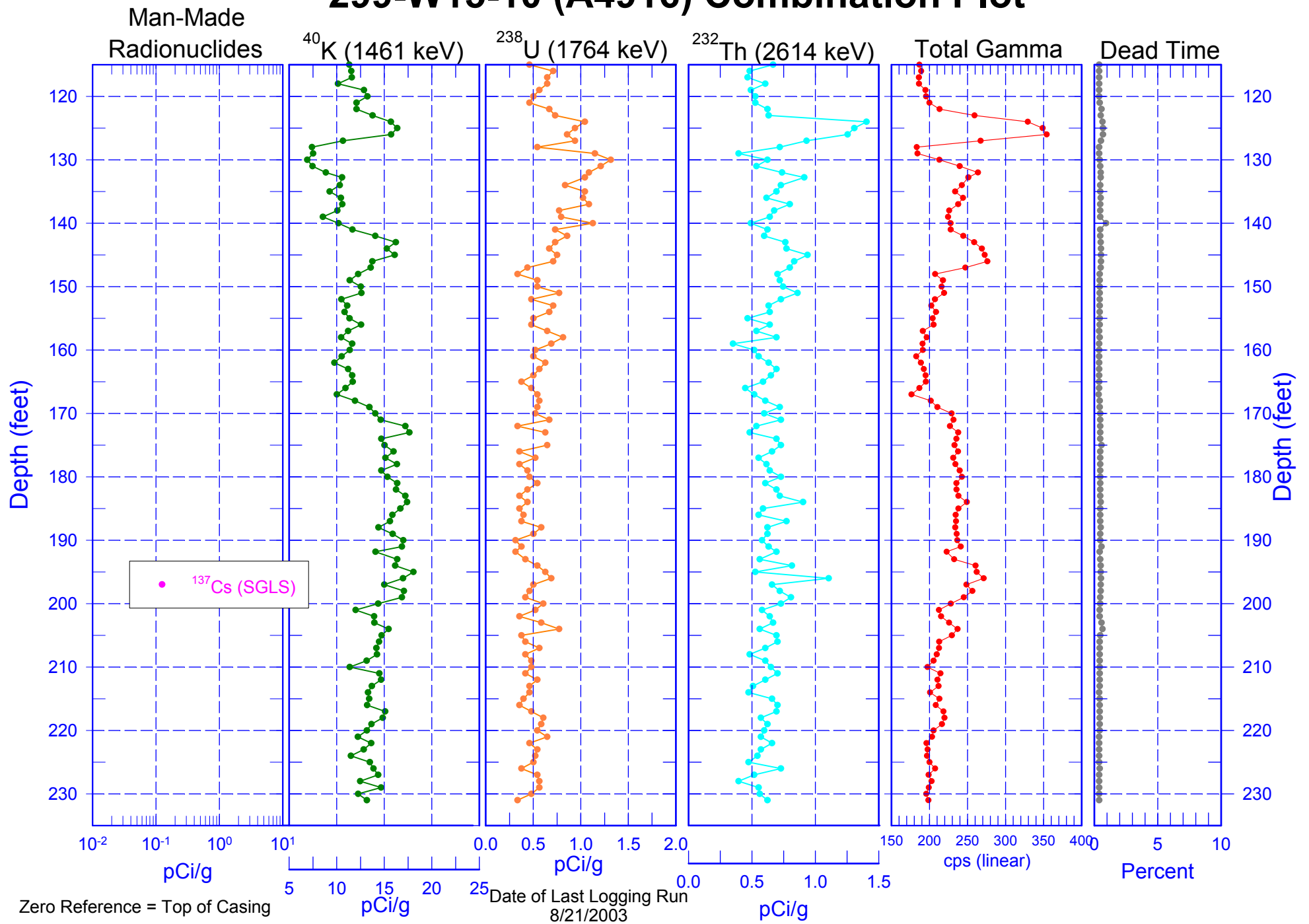
Zero Reference = Top of Casing

Date of Last Logging Run
8/21/2003

299-W15-10 (A4916) Combination Plot

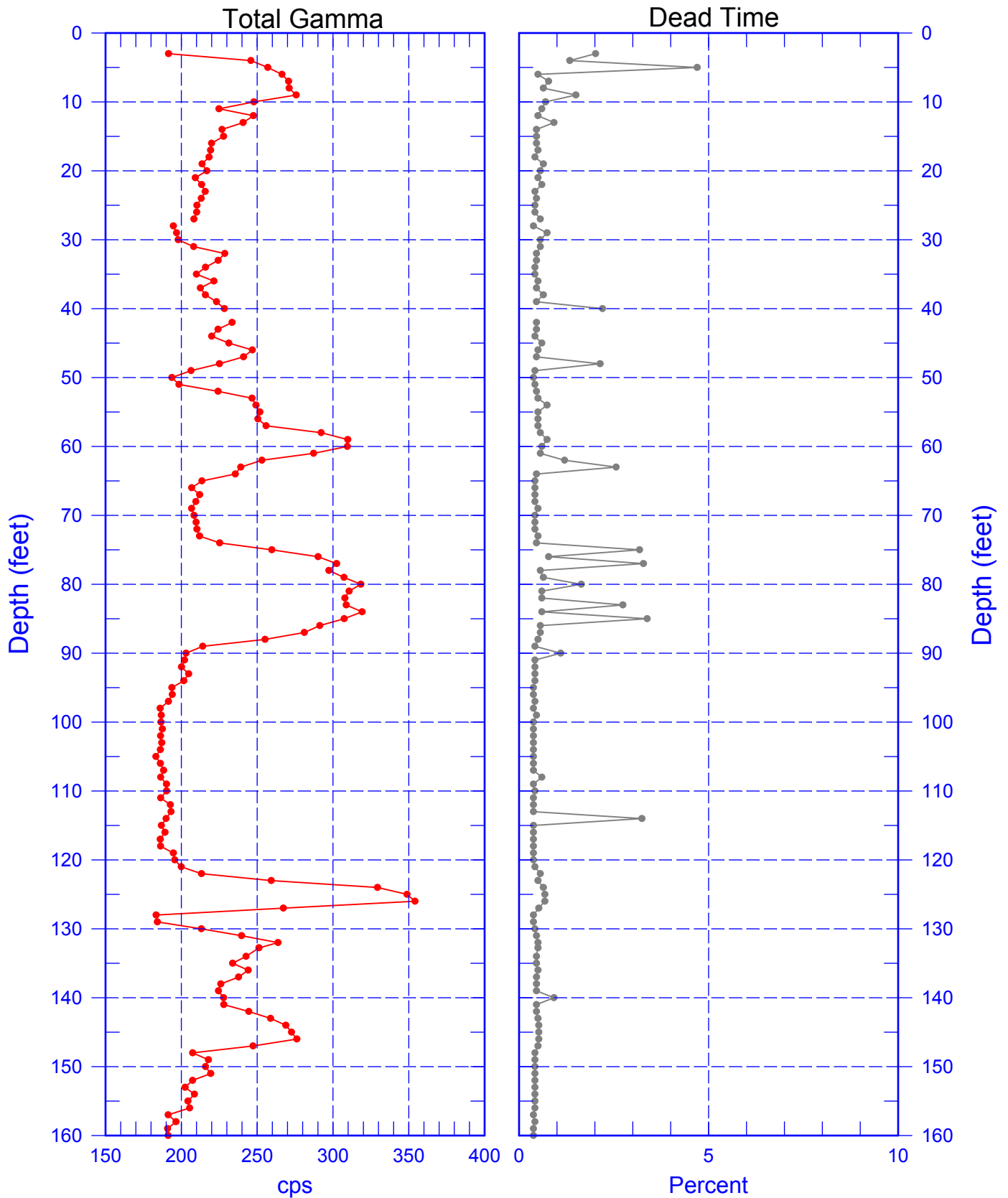


299-W15-10 (A4916) Combination Plot



299-W15-10 (A4916)

Total Gamma & Dead Time

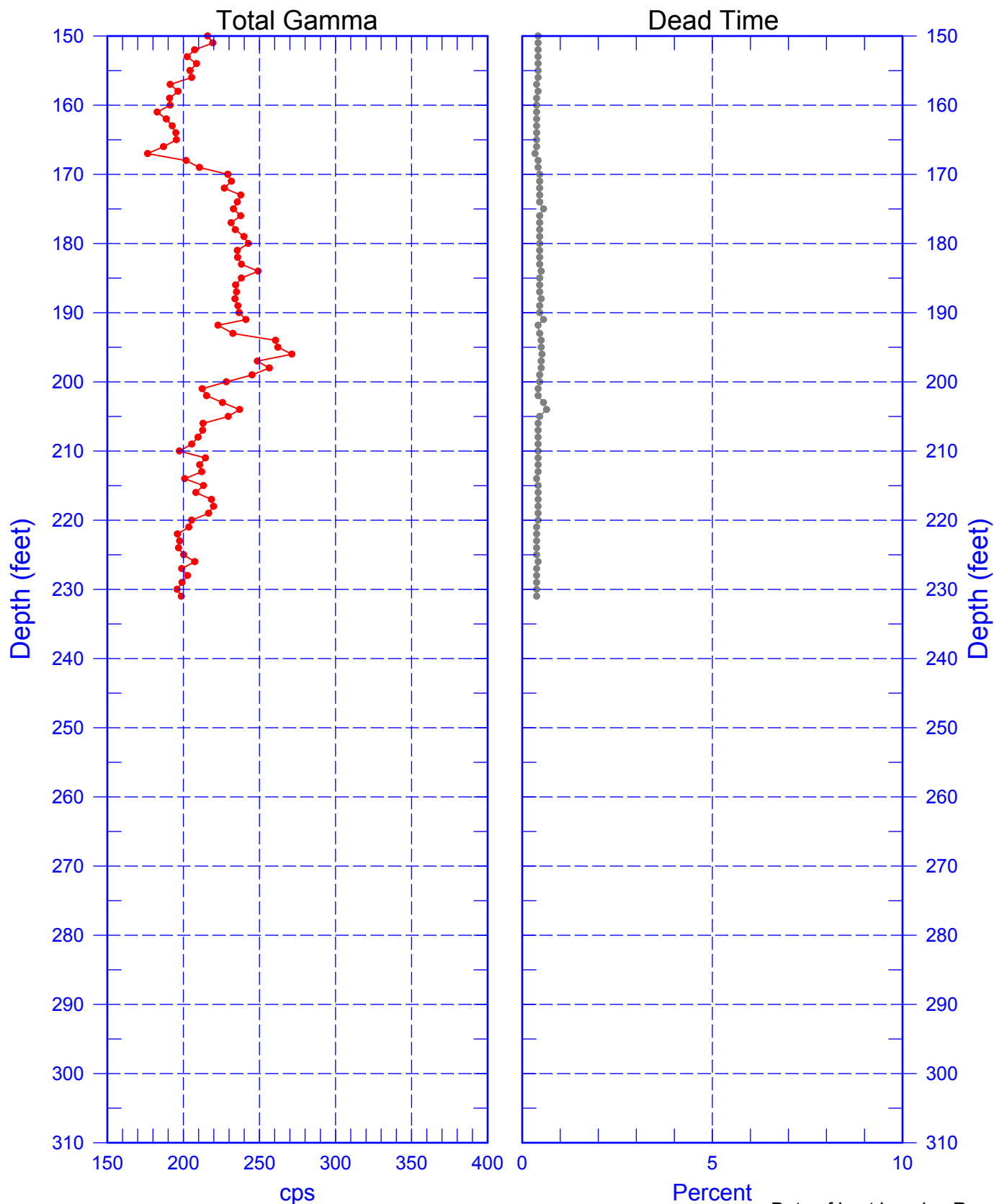


Zero Reference = Top of Casing

Date of Last Logging Run
8/21/2003

299-W15-10 (A4916)

Total Gamma & Dead Time

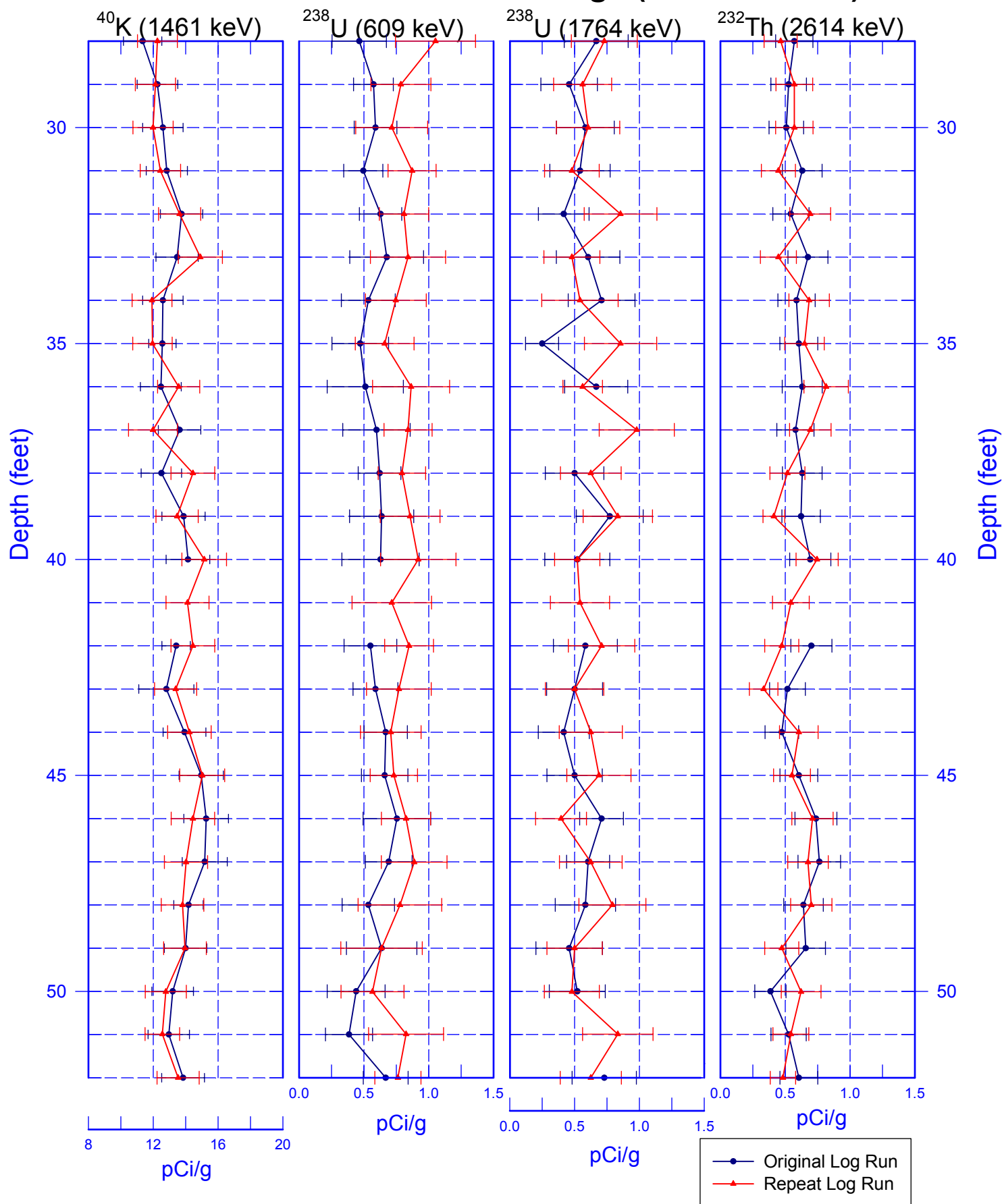


Zero Reference = Top of Casing

Date of Last Logging Run
8/21/2003

299-W15-10 (A4916)

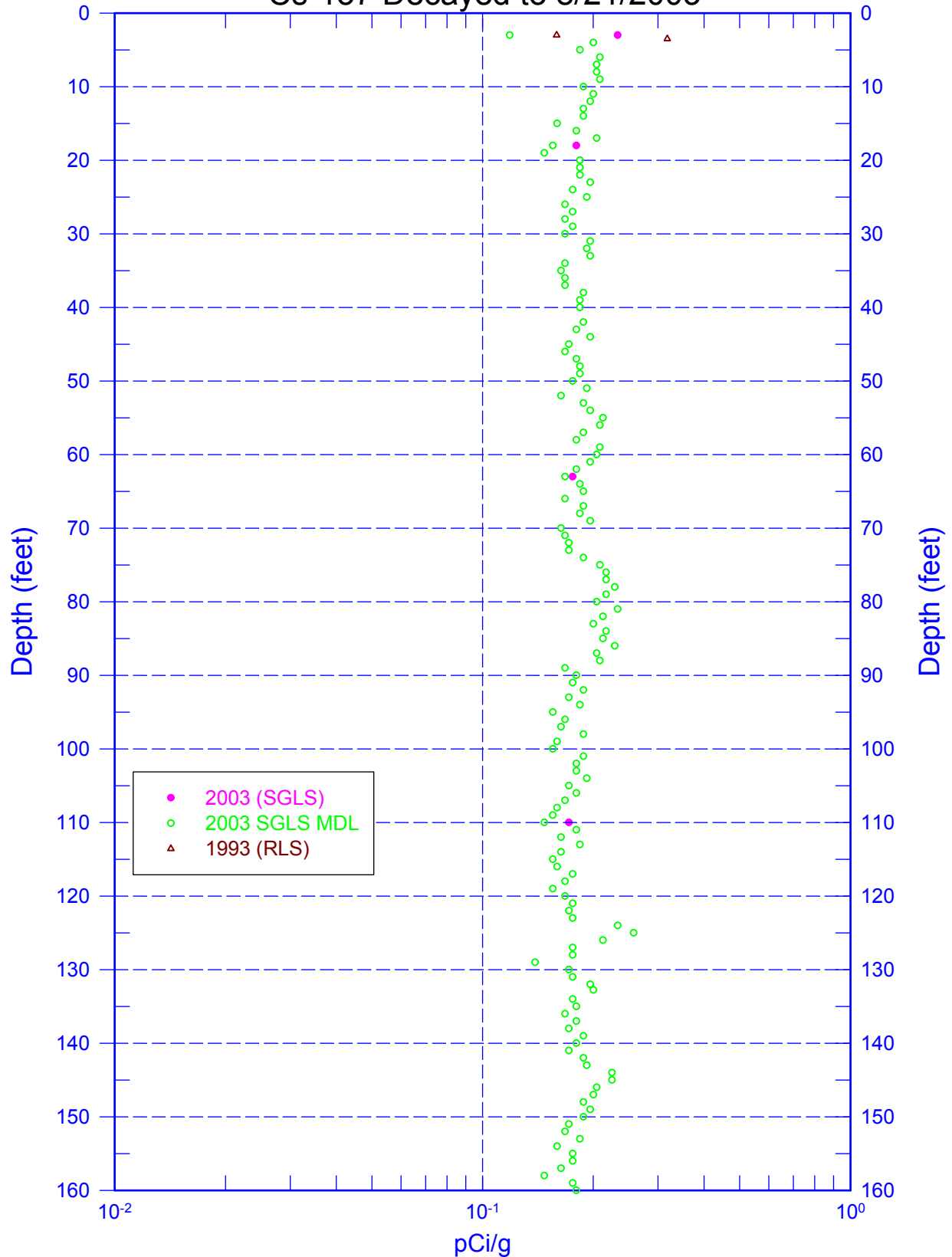
Rerun of Natural Gamma Logs (52.0 to 28.0 ft)



299-W15-10 (A4916)

RLS Data Compared to SGLS Data

Cs-137 Decayed to 8/21/2003



Zero Reference = Top of Casing (2003 SGLS)
1993 RLS shifted +3.0 ft to agree with SGLS